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A CONTRIBUTION TO BRAIN SURGERY.

SIX SEVERE OPERATIONS ENTAILING PROLONGED MANIPULATION OF THE ENCEPHALON.

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CASE I. *Terminal dementia of alleged traumatic origin. Trephining and exploration of brain, with great improvement, lasting nine months; relapse. Second operation; marked and increasing improvement.*—May M., æt. twenty-eight, American by birth and parentage, and of good education; of rather slight physique but always in fair health. There is no family taint of insanity or personal history of neurotic tendency or mental instability. In April, 1884, she became deranged, the mental disability continuously increasing. In July of the same year she was admitted to the Illinois Hospital for the Insane, at Elgin, in the service of Dr. Church, and entered on the records as a case of subacute mania. The father, a very well educated and intelligent man, subsequently stated that the only assignable cause for his daughter's alienation was a knock she had given her head in coming up a cellar stairway. She was stunned by the blow and delirium lasting a few hours resulted. The details of this accident, coming through third parties, are not entirely reliable, and the portion of the head struck could only be inferred. A few days afterward a lady whom she was visiting thought her "out of her head." Gradually she grew worse, and finally was so unmanageable, though never violent, as to require hospital treatment and restraint. During her residence in the asylum she never manifested any symptoms of head injury or indications of focal trouble in the cortex, but her mania ran an ordinary course to a chronic stage and complete dementia. She became filthy in her habits, at times destructive of clothing, at times noisy, but for the most part sat idly, silently, stupidly wherever placed, indifferent alike to spoken directions and the demands of nature. In this condition she was discharged from the hospital and removed to her home as incurable, January 1, 1889.

The father had elaborated and tenaciously clung to the idea that traumatism was the cause of his daughter's insanity. He gave the case his constant study, made casts of her head, and urged that surgical measures be taken because a slight flattening of the skull over the right coronal suture led him to suspect fracture of the inner table, or compression. While at the asylum several consultations were held to determine the advisability of the operative interference he desired, without confirming his views and equally without shaking his opinion.

February 23, 1889. Admitted to St. Elizabeth's Hospital under the care of Dr. Frank. It was noted that she walked with a shuffling gait and dejected air, that she was constantly muttering and had a vacant look, wandering aimlessly about, picking and tearing at her clothing, and that she was heedless of the calls of nature, often soiling herself. It was impossible to attract her attention for a moment. She had to be fed by the nurse, and this was only accomplished with much persistence and difficulty. Examination of chest, abdominal and pelvic organs detected nothing wrong. There was no paralysis, or abnormalities of general sensation, or the reflexes. Dr. W. Franklin Coleman, ophthalmologist to the hospital, examined her eyes and made the following report:

"Reads most letters of No. XX. Snellen at twenty feet with either eye. She will not name some of the letters of No. XX., probably on account of her mental condition. With the ophthalmoscope refraction is emmetropic. The fundus of each eye looks normal in every respect. An attempt to test the ocular muscles with prisms failed to elicit any answers. The excursions of the eyes and the associated movements are apparently normal."

When the head was shaven there was some lack of symmetry, the right parietal surface anteriorly being lower than the left. There was no abrupt depression or traces of injury upon the scalp, and as a brother exhibited exactly the same conformation, it was considered congenital and it was decided not to operate. The father, however, persisted that an operation be done and was anxious to assume all risk, feeling that the girl might better be dead than in the condition she then presented. He asserted his determination to take her from one surgeon to another until some one was found to undertake the surgical measures he felt sure would relieve her. At this time she was seen by Dr. Brower, Professor of Mental Diseases in Rush Medical College, etc., who gave the following written opinion, January 26, 1889:

"After consideration of your daughter's case I have reached the following conclusions:

"1. That the insanity was caused by the injury, because of the absence of any other possible cause and the immediate connection between the two.

"2. That the injury need not have produced fracture or depression of the skull to have resulted in insanity.

"3. That the depression of the skull of your daughter may be congenital, but its situation with reference to the injury makes it possible that it may have been produced by it.

"4. This probability justifies exploration of the surface of the skull, and possibly trephining.

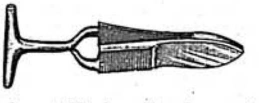
"5. That it is not unreasonable that even if the insanity is due to the injury the long duration of the disease may make the result of the operation negative.

"6. That the danger of the operation is so slight that it should not weigh against the possible benefit."

In consequence of this opinion, in which Dr. M. H. Luken, Attending Physician to St. Elizabeth's Hospital, entirely concurred, and the father's determination, it was decided to operate, and if nothing were found in the skull-cap or meninges to explore the brain itself.

April 2, 1889. The head was again shaved and the patient given a sublimate bath, after which the head was thoroughly scrubbed, cleansed with sublimate solution and enveloped in an antiseptic dressing to await operation, which was done the next day (April 3d) by Dr. Frank, in the presence of Drs. Holmes, Newman, and Hall, with the assistance of the hospital staff and Dr. Luken. Chloroform was used. The head was once more thoroughly washed with sublimate solution and the part of the skull to be attacked—namely, the slight depression in the right anterior parietal region—marked out upon the scalp. With a small drill the scalp was transfixed and the cranium scored that the proper position might be readily found after the scalp should be lifted. The field of operation was then embraced in a horseshoe-shaped line of interlocking silk stitches, which, being tightened and tied, completely controlled hemorrhage. An incision was made within the row of stitches, forming a flap with its base toward the brow, its convexity posteriorly and including the periosteum. The flap was rapidly separated from the cranium and bleeding points on its margin were secured by hæmostatic spring clip forceps, especially devised by Dr. Frank, having a wide transverse bite to prevent crushing and at the same time to include a larger portion of the flap's edge than could be controlled by an ordinary instrument.

FIG. 1.



Spring-clip forceps for controlling hemorrhage from margin of scalp flap. Two-thirds actual size.

By means of a suture to the brow the flap was kept out of the way and four buttons of bone, three-quarters of an inch in diameter, were removed by an ordinary conical trephine. These were immediately placed in a bowl of warm sterilized water to which an assistant gave scrupulous attention, maintaining the temperature as nearly as possible at 99° F. With the rongeur the cranial opening was freed from its sharp points and bridges of bone and the margins properly smoothed, all fragments and chips being placed with the buttons in the warm water. No indications of traumatism were presented by the portions of bone removed or by the exposed dura, which showed the normal cerebral pulsations and did not bulge into the opening. The finger, swept widely around between the dura and the skull in all directions, encountered only normal anatomical points.

Two branches of the middle meningeal artery were ligated by passing an armed needle under them, and the dura was opened at a distance of one-quarter of an inch from the bony margin, care being exercised to interfere as little as might be with its blood supply, in order to preserve its vitality—upon which, of course, depend its primary union and the prevention of cerebral hernia. With this in view the base of the flap was formed toward the body, from which direction it receives its blood. When turned down it was protected from abrasion by instruments or the sharp edge of bone by a few folds of warm gauze, and secured in a favorable position by a suture to the ear.

Immediately upon opening the dura there was a gush of cerebro-spinal fluid, probably four ounces at once escaping, and the arachnoid and pia looked œdematous and jelly-like, all the meshes being filled with the same colorless fluid. The under surface of the dura was palpated in all directions as far as the length of the finger permitted, except across the median plane, where it was stopped by the falx. In this way the sharp margin of the lesser wing of the sphenoid and the ridge of the petrous portion of the temporal were readily made out. The œdematous arachnoid presented high vascularity and threatened serious hemorrhage if interfered with. In attempting to take up the engorged vessels the tissues tore through, but surprisingly slight bleeding ensued. Consequently, with dissecting forceps in each hand the turgid vascular membranes were freely stripped from the convolutions over the entire field of operation and the flow of blood was readily controlled by a little pressure. With fingers and a spoon handle the sulci were carefully opened and examined but nothing abnormal could be found. Finally, a minute portion of the brain tissue was removed for microscopical examination. The cortical region exposed embraced the ascending convolutions in the area for the arm centres and the middle third of Rolando's fissure. The irrigator was freely employed, charged with sterilized water, at all stages of the work.

All bleeding parts having been controlled the dura was replaced and secured by catgut sutures in accurate position, a drainage-tube full of iodoform wicking being passed under one corner and lying on the surface of the brain. The buttons of bone and all small chips and fragments were replaced and iodoform wicking packed in, around, and between them for the purpose of drainage and to assist in maintaining them in position, the strands coming out with the brain drainage at the most dependent portion of the scalp wound, which was closed with numerous suture points. The interlocking stitches were then removed, the head properly cleansed, and completely enveloped in a very ample antiseptic gauze dressing.

The patient rallied nicely from the anæsthetic, passed a quiet night, and no untoward symptoms were developed at any time. The temperature never reached 100° F.

No convulsions, vomiting, or stupor appeared, but a gradual gain in mental power, memory, habits of cleanliness, and deportment was noted from the first.

The condensed daily record follows:

April 4. Asked for a vessel, a thing she had not known enough to do for years, and is brighter mentally.

6th. The drainage-tube was removed. There has been a considerable discharge of cerebro-spinal fluid on the dressings.

9th. Motor power in left hand diminishing, probably from interference with the arm-centre at the time of operation. Began to menstruate the first time in many months.

10th. Not so bright mentally, and seems in danger of relapse into her former demented condition.

11th. Head dressed. Is up and around room eight days after operation.

13th. No control of muscles of left arm. Answers questions rationally and readily. Received a letter from her father which she enjoyed and read without a mistake. Commenced a reply this afternoon, but after a few words lost coherence.

15th. Left arm blue and cold, but sensation is not appreciably impaired.

16th. Mind growing stronger, and she is cleanly in her habits.

20th. Visited by her father, who saw much improvement in her condition.

22d. No reaction to faradism in left forearm and hand. The replaced bone buttons seem firmly united.

26th. Paralysis diminishing. There is slight voluntary movement in flexors.

27th. Faradic and voluntary contractions in muscles of left arm and forearm increasing.

28th. Color of hand normal, but still colder than its fellow. Patient is quiet in deportment and answers all questions rationally and correctly.

May 1. Paralysis completely gone. Wound in scalp healed soundly by first intention, and there is firm union between the buttons of bone and the cranium—the conformation of the skull being much what it was before operating. To-day had eyes examined by Dr. W. Franklin Coleman, who reports as follows:

"The ocular muscles are examined especially as a test of the patient's present intelligence. During the previous examination she kept up a constant muttering and could not be induced to hold her head quiet, which made the examination of the fundus somewhat difficult. Her manner is now quiet and attentive, still with an air of sadness. She answers promptly questions concerning her residence, age, etc., though she states she is seventeen. Upon testing her ocular muscles by prisms and a lamp at twenty feet, her answers are now remarkably prompt and consistent, even during tests for adduction, abduction, hyperphoria, etc., which were many times repeated. As an evidence of very intelligent observation, I cite the report of one test. Diplopia is produced with a prism base up before the left eye, and then the base is inclined toward the median line. She readily and correctly described the lower image belonging to the left eye as 'horizontal,' 'out of the vertical,' and 'to the left side of the upper.'

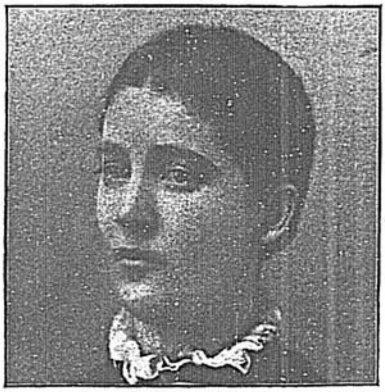
"At twenty feet adduction—right eye, 5°; left eye, 3°. Abduction, right eye, 5°; left eye, 6°. No hyperphoria. I have examined the ocular muscles of many patients whose mental capacity was unquestioned, who did not give more ready and intelligent answers than the above patient. The transformation in the mental action of the patient in so short a time after operation is the most gratifying and phenomenal instance I have seen."

4th. Patient was discharged and returned to her home in the country.

The following account of her conduct and condition after leaving the hospital is furnished by her father, who watched her carefully and intelligently, and Fig. 2 is from a photograph taken two months after the operation.

February 21, 1890. "On arriving home my daughter's friends observed that she was weak in body. Her mental health presented a great change. As near as we could determine she was no longer insane.

FIG. 2.



From a photograph taken two months after the first operation.

The utter disregard of the calls of nature, which had characterized her conduct for nearly five previous years, had entirely changed, and this improvement has continued from that time, with one minor exception, until the 10th of this month. Her mental powers were very feeble. At first she could not remember her own mother's name, and she had the idea that she had been at the asylum only four months instead of four and a half years. A week or so after her return she gave me correctly the names of the Presidents. Her memory of former years returned so that it was fully as good as that of the other children. Through the summer and early autumn she would help the children with difficult problems in arithmetic, and much of her schooling returned to her. She gained in bodily strength, doing a share of the housework, mending her own garments, attending to her roon, and once in a while cooking a meal for the family. Without great care on our part she would eat too heartily, which would be followed by spitting up of food. This habit was entirely overcome, and has not troubled her for two months past.

"Some time in August she had a very light fit, my wife thinking at the time that she was only choking a little. About four weeks later she had another, somewhat more severe, and then at intervals of about a month three more quite severe ones, losing consciousness, foaming at the mouth, with thumbs of one or both hands turned upon the palm. Subsequently, at the menstrual periods she had lighter fits. The menses have been regular, sufficient in quantity, and of proper color. Following the fits for two or three days she would seem more than usually childish and simple. We began to fear her insanity was to return, and these fears were realized about the 1st of this month, untidiness appearing. She seems in better physical health than a year ago, but the character of her insanity is quite the same as of old."

February 27, 1890. The patient was readmitted to the St. Elizabeth's Hospital in a comparatively fair physical condition, but mentally she was nearly as bad as before the operation, yet with more activity and presenting moments of good behavior and of industry. It was impossible to fix her attention except momentarily. She would wander aimlessly about and was very disorderly, untidy, and regardless of all propriety.

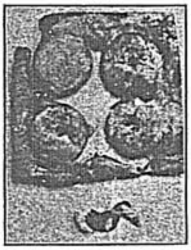
March 17. She was shown before the Chicago Medical Society and another operation in the same region was advised by Dr. Dewey, Superintendent of the Illinois Eastern Hospital for the Insane, at Kankakee, and by Drs. Brower, Luken, and Church, of Chicago, to determine the condition of the skull at that point and that of the underlying parts. The convulsions dictated the election of this site, and with the improvement formerly obtained, and possibly now to be expected, justified renewal surgical interference.

SECOND OPERATION.—*March* 24, 1890. Having been prepared for the operation as before, Dr. Frank operated in the presence of Drs. Steele and Church, and with the assistance of Drs. Luken, Lawson, Beard, and Shuman. Chloroform was employed.

A line of interlocking stitches was placed about one-half inch outside the horseshoe-shaped cicatricial line of the former incision. By alternating black and white silk they were readily selected, and, when tied, completely controlled the circulation. An incision, eleven inches long, was made between the interlocking stitches and the cicatrix, embracing the latter and conforming to it, and a flap including the pericranium was rapidly turned up. At the site of the former trephining adhesions existed, and vascular fibrous processes, extending in some places between the bones, and through the central trephine-pin openings in the buttons. These had solidly, and for the most part by bony process, united to the skull forming a firm protection to the brain. The numerous small fragments of bone, chips, etc., had all been absorbed with the exception of three pieces, about the size of barley corns, which were burnished and also rapidly being absorbed, evidently only playing the part of aseptic foreign bodies, and located in the quadrangular space bounded by the four buttons. They are shown in Fig. 3 below the larger portion of bone.

By means of a Hey's saw, an area one and three-quarters by two inches was marked out, embracing the former skull opening, and, with the same instrument, freed from the surrounding bone. In order to lift it out it was necessary to chisel away one corner, when with an elevator it was removed almost in one piece. It is accurately represented in Fig. 3. Upon the surface of the normally pulsating dura the outline of the buttons and the interstices was clearly marked by fibrous scar tissue, which was neatly dissected off before proceeding.

FIG. 3.



Two-thirds actual size. Section of skull removed at second operation, showing union of trephine buttons and below the three small fragments found in the central space which were undergoing absorption. On the margin of the left lower button another small chip is firmly united. The union between the buttons and the cranial margin is apparently bony.

The dura was next opened and cared for with the precautions formerly employed and above described, displaying the turgid, dark-red convolutions, not adherent to the dural cicatrix or apparently injured by former manipulation. A tolerably strong faradic current was applied to various portions of the uncovered brain through two pointed and sterilized electrodes, but produced no peripheral movements whatever. This suggests the probability that the restoration of motility in the left hand after the paresis following the first operation was brought about by the vicarious action of the left brain arm-centres. As before, the inside of the skull and dura mater and the surface of the convolutions was explored with the finger as far as could be reached in all directions without encountering adhesions or anything abnormal. The brain now seemed to fill the cranium properly, and there was no excess of fluid. The wound was closed in the same manner as after the first operation, except that the bone was not replaced.

Referring, again, to the valuable specimen thus obtained (Fig. 3), it teaches the old lesson that close apposition is desirable for bony union, and that, other things being equal, a large section of bone stands a better chance of surviving and being again united to the cranium than smaller and loosely applied fragments. It would probably be well to fix the portions of bone replaced by pins of bone or ivory, or by nailing. Possibly when a saw is used, by bevelling the cut proper apposition may be secured.

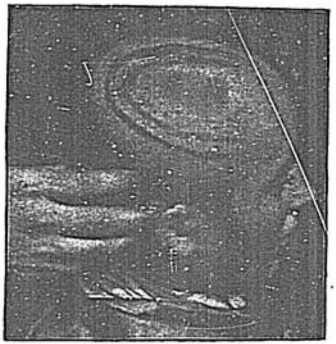
The patient rallied promptly from the chloroform and presented no indications of shock or paralysis. Convalescence from the operation was unmarked by any notable physical or surgical features. On the 28th there was an evening temperature of 101° F., but it fell the next day and remained thereafter within a small fraction of the normal point. The head was at first dressed daily and later at longer intervals. The drainage was gradually lessened and the wound united by first intention, no pus being seen.

April 3. She sat up and wrote a few words to her father quite coherently. This is the ninth day after the operation.

5th. She was up and around, her mental condition showing improvement.

On the 9th of April she manifested, when questioned by Dr. Church, a considerable degree of memory, intelligence, and appreciation of her condition and surroundings. She showed natural emotion when told of a slight illness which prevented her father's promised visit and read a short letter from him without difficulty and with appreciation. She was anxious to return to her home. She made all her wants known and waited upon herself intelligently, going to the closet as necessary, and presented a great contrast to the condition which had been manifest before the operation.

FIG. 4.



From a photograph taken twenty-three days after the second operation, showing the lines of both incisions and the drainage openings of the latter with the central depression marking the opening in the skull.

16th. Fig. 4 shows the condition of the scalp and skull upon this date, a slight depression appearing at the cranial opening which showed the pulsations of the brain.

19th. The father writes the following:

" I have this day visited my daughter May. She at once recognized me, kissed me, inquired about my recent illness, was affected to tears, talked quite rationally, asked after particular individuals at home, said she wanted to go home and would like to go at once. I think, making allowance for the small opportunity of judging which I have had, that she now presents a more hopeful and better condition than at a corresponding interval after the first operation."

24th. Is still improving and can now be trusted to do little tasks and to run errands about the hospital. At times she mutters a little, but expresses herself as feeling very well, without pain or discomfort. She is very neat and orderly. What the ultimate result of this operation will be can only be surmised, but the present improvement is very gratifying to all concerned.

CASE II. *Jacksonian epilepsy. Trephining and removal of branching sarcoma; improvement of all symptoms: relapse from probable recurrence of neoplasm.*—Peter H., æt. thirty-nine; a married German carpenter with four healthy children and no family history of neuroses or personal record of neurotic tendency. He had always been in good health and strength, though exceedingly phlegmatic and sluggish in speech, gait, and mental action. July 12, 1888, while working on a building he suddenly fell forward and remained unconscious for half an hour. After an hour of stuporous sleep he rallied, walked some distance to his home, passed a fair night, and in the morning, feeling as well as usual, returned to his work. At the same hour he again lost consciousness, and presented the same train of symptoms as the day previously.

In falling the first time he is said to have struck his head in the frontal region, but nothing very definite is to be learned about it and no mark was left. From this time forward, about once a week, sometimes at longer intervals sometimes at shorter, he had a convulsion, and one day in August had four. These attacks presented the following features: Invariably the first symptom was pain and spasm in the right index-finger gradually involving the rest of the hand, spreading to the wrist and passing up the arm. The extremity presented a flexed attitude and rapid clonic movement. When the body was reached consciousness was lost, and the patient, if not in the recumbent position, would fall. The clonic movements then became general without a tonic stage, and often would persist as much as fifteen minutes by actual observation. During the clonic phase of the attack the urine would be voided, the tongue bitten, the head retracted, the eyes turned up, and all the extremities would be thrown about equally into movement. A stuporous sleep of about an hour would follow, after which full consciousness was restored until the next attack.

Later on the pain in the hand and fingers became constant and excruciating, preventing sleep, rapidly undermining the patient's strength and causing him to move constantly about seeking relief. His attitude was peculiar, his face expressive of intense suffering, and he continually rubbed and held his right hand with his left. He lost weight and strength and became weakened on the right side. The convulsions recurred at about weekly intervals.

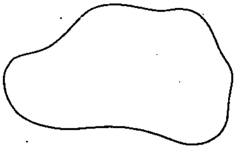
January 25, 1889, he was admitted to St. Elizabeth's Hospital in the service of Dr. Coleman in substantially the condition above indicated. There was neither history nor trace of syphilis. Mentally he was very sluggish and very little beyond "Yes" and "No" could be elicited by questions. When standing, the right hemiplegia was manifested by the trembling knee. The right arm and forearm measured one-half inch less than the left, and the hand and arm were in constant rigid flexor contraction drawn to and across the body. Any attempts to straighten the limb gave rise to great suffering. Tactile sensation was fairly acute, and there was no sphincteric weakness.

The reflexes, eyes, which were carefully examined by Dr. W. F. Coleman, muscular sense, and urine were normal. He had constant pain in the head, in the frontal region, which, when intense, passed over the vertex to the occiput. Percussion gave rise to a little tenderness on the left side of the head, but nothing distinct. He walked with a broad base as if he had "sea legs on," but his wife said this was natural to him. He presented a very peculiar and tortured picture with his agonized face, his rigid arm, his constant motion to secure relief, the hand enveloped in flannels and liniment or hot applications and carefully supported with the left.

Various plans of treatment were faithfully employed without benefit, and under the impression that the trouble might be peripheral, in the cervical and brachial plexuses, suspension was tried. The first time it caused a convulsion in a few seconds, but afterward was tolerated. From the nature of the convulsions and the general aspect of the case it was ultimately decided that there existed an irritating lesion in the left cortex involving the arm- and particularly the hand-centres, and causing the discharge of those regions manifested in the kinetic display above described. An operation was planned to uncover this area of the cortex and in the absence of demonstrable lesion to excise the faulty centre indicated by the signal symptom—that is, by the initial spasm in the right index-finger, as advised by Horsley. Consequently the patient was prepared for operation as in Case I., and the fissure of Rolando was marked out upon the scalp by a combination of the rules of Reid, Horsley, and Hare. The arm- and hand-centres were carefully delimited.

May 21. Under chloroform, with the assistance of Drs. Luken, Lawson, McCallum, and Kellog, in the presence of Drs. Coleman, Newman, Hall, and others, a flap four inches broad at its base anteriorly and five inches long, including the pericranium, was raised, hemorrhage having first been controlled, as formerly described, by the interlocking stitches. The further technique of the operation did not materially vary from the procedure in Case I. The pulsations of the brain were normal and nothing unusual was found, but just when it had been decided to close the wound, near the anterior margin of the trephine opening a small node on the surface of the convolutions was noticed, differing in color

FIG. 5.



Outline of opening in skull over left motor region. Reduced one-half.

from the surrounding brain and distinctly firmer to the touch. The cranial aperture was enlarged in this direction, and a thickened cicatricial-appearing mass was found, having the size of a large bean, from which radiated filamentous processes reminding one of a large spider. In order to reach all of it, five buttons of bone were removed with a three-quarter inch trephine and an opening in the skull, the shape and twice the size shown in Fig. 5, made from a tracing taken at the time, was formed with the rongeur. It embraced the middle and lower thirds of the Rolandic fissure, the corresponding portions of the central convolutions and the speech-centre in the third frontal gyre.

The growth was then dissected away as completely as possible, causing the decortication of the brain to a depth of a quarter of an inch over an area larger than a silver dollar, and embraced in the anterior two-thirds of the skull opening. Irrigation was freely employed as in ordinary wounds.

The dura was carefully closed, drainage from the surface of the brain having been provided for by means of a rubber tube filled with iodoform wicking, and the buttons of bone and all fragments, however minute, were replaced, being, as in Case I., supported and drained by meshes of wicking which followed the other drainage out of the dependent part of the wound. A drainage tube also passed under the flap across the field of operation, and the scalp was closed by interrupted sutures. The usual ample gauze dressing was employed. The operation lasted two and a half hours, but was not attended by shock or notable depression.

The following condensed notes were made by the interne, Dr. McCollum, now of Oakland, California.

May 22. Day after operation. Passed a quiet night. The face is drawn to the left. Right hand paralyzed and right side paretic. Sensation is fairly acute. Cannot form words in reply to questions, but repeats words after hearing them. Tongue protruded with difficulty and to the right. Pain has left the right hand. Toward evening the dressing was changed, being soaked with a large quantity of sanguinolent fluid. The anterior portion of skull opening pulsates; the posterior portion is fairly firm to the touch. Patient sat up and drank a little milk, but is liable to lose it from the right corner of the mouth. Temperature, 7 A.M. 97⅗°, at 9 P.M. 100⅗°.

23*d*. Rather restless. No control of bladder and rectum. Motion on right side improving. A little twitching at times on right side of face. Drainage-tube shortened one-half inch. The scalp is œdematous. No pain. Temperature, 7 A.M. 98°, 9 P.M. 100°.

24*th*. Slight improvement in motion of right lower extremity. Has a little pain in right hand, which is partly flexed again. Articulation improving. Temperature, 98⅗° to 99⅗°.

25*th*. Stationary.

26*th*. Dressing changed. The œdema of scalp is gone. Half the stitches were removed. Pulsations are less marked. Most of the wicking was withdrawn. Temperature normal.

28*th*. Improvement in speech. Dressing changed. All drainage removed and the remaining stitches, which produced some twitching in the right arm. With closed eyes cannot locate a pin-prick on right side, but feels it promptly and keenly.

30*th*. A little suppuration in lower angle of wound. Introduced a few strands of iodoform wicking for drainage after removing a couple of stitches which had been overlooked.

31*st*. Restless during the day and toward evening stuporous and hard to rouse. No control of sphincters since operation. Hand and face on right side quivered a little to-day.

June 1. Brighter. Bowels have acted under saline. Temperature normal.

15*th*. Steady improvement in all particulars. Muscles react to faradism and less strongly to galvanism. There is a tendency to flexor contraction of right hand and arm, which can be overcome only with difficulty, but without pain. At various times this extremity has presented marked twitching. From the wound there is still a little discharge and several small pieces of bone have come away. Has rather better control of his bladder. Sits up an hour or two each day, and enjoys his pipe, which shows a fair control of facial muscle, and no longer lets fluids run out of the right corner of his mouth.

18*th*. The dressing showed considerable discharge and some dead bone. There is considerable œdema. Patient weaker. Temperature 100°; pulse 92.

19*th*. Patient losing ground. Temperature 100⅗°; pulse 100. A few drops of pus on dressing. Had a slight chill during the day.

The face was drawn more to the side, fluids again escaped from the corner of the mouth, speech was impossible, the motor power of the right arm and leg had disappeared, the facial expression was anxious. These symptoms, with the chill, rise of temperature, and slight amount of pus found on the dressings pointed to the formation of an accumulation of pus within the cranium and in the field of the former operation. It was decided to open the skull again and explore the brain without delay.

SECOND OPERATION.—*June* 20, 1889. Under chloroform an incision four inches long was made through the united flap longitudinally and over the long diameter of the skull opening, laying bare the field of the former operation. Two of the trephine buttons were found tilted up and making pressure upon the brain. All the trephine and other fragments were removed except one button at the highest part of the opening which was allowed to remain, as it looked partially healthy and gave promise of uniting to the cranium. Some of the fragments presented a condition indicative of vitality, while others were bleached white, and evidently either to be cast off or encysted. Through a minute opening in the dura, so small as to prevent drainage, and not admitting a fine probe, a drop of pus could be expressed. An incision opened into a cavity containing about an ounce and a half of thick, cheesy, odorless pus, and was first explored with a narrow forceps, and then with the finger, which was introduced its length, two and three-quarters inches, in the direction of the body of the sphenoid, but whether the ventricles were invaded or not could not be determined. Careful search was made in all directions with the finger to determine the presence of any other accumulation without result. The cavity was freely irrigated. Considerable cerebral fluid escaped during the manipulation. A drainage-tube seven-eighths of an inch in circumference was introduced to the bottom of the cavity, requiring four inches of length to reach to the bottom.

The scalp-wound was duly closed, and the head dressed as formerly. The temperature immediately fell, and at 1 P.M. was 99⅕°; the operation being done by 9 A.M. Toward evening the patient was much brighter, and ate a light supper.

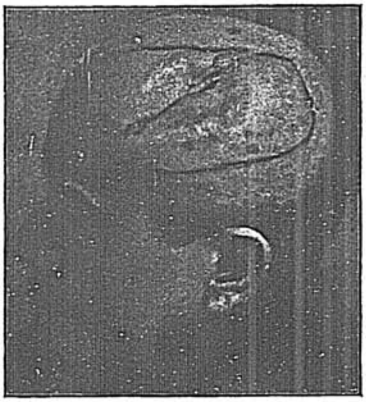
21st. Bowels moved in bed during the night. His voice is stronger and he articulates "Yes" and "No" much louder and more distinctly. Temperature 99½°. Right side completely paralyzed.

22d. Complains of pain in the head and face. Can use the bed urinal, but soils the bed with bowel movement. Temperature 98⅗°.

23d. No change.

24th. No voluntary movement. Improving articulation. Drainage-tube taken out and replaced. It contained a little fluid, some pearly bodies, and a few membranous shreds, but had attached to its extremity a tubular glistening sac about three inches long, evidently the lining of the old pus cavity. Examination shows this to be made up of fibrous material of a very firm and rigid sort, staining but poorly, and looking almost chitanous under the microscope. It presents no nerve elements.

FIG. 6.



From untouched photograph showing cicatricial lines of incision for first and second operations, and pulsating depression at site of cranial opening.

25th. Temperature normal.

26th. Temperature normal. Mentally improving.

27th. Head dressed and drainage-tube shortened a half inch. Remaining stitches removed.

July 4. There has been steady and uninterrupted improvement in speech. He can flex the right hand a little. Complains of a little pain in frontal region. A counter-opening was made under the scalp, and some wicking drawn through to favor better drainage.

7th. Walked half-way across room. Temperature always normal.

10th. Motion is returning in hand and arm. Shows slight movement in fingers, thumb, wrist, and elbow.

17th. Walks with very slight dragging of right leg. A little pain in right arm. Reflexes equal and normal. Movements all improving.

August 15. Steady improvement in all particulars. He has fair control of right hand and side. Free from pain and convulsions.

September 7. Three and a half months after operation. Had an epileptic attack last night.

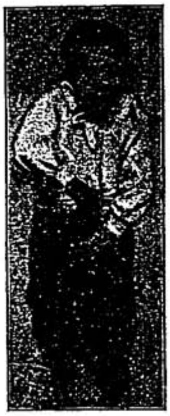
The condition of the head and scalp is shown in Fig. 6, from an untouched photograph.

Examination of the growth removed at the first operation determined it to be sarcomatous, and its wide ramifications had doubtless precluded its entire excision. The convulsions returned after the last date in a generalized form marked no longer by localizing symptoms, but usually the patient had a feeling that he was to have an attack, and could prepare for it. It was probable that the neoplasm had recurred, and was of wider extent and distribution, in view of which further operative interference was deemed inadvisable.

The patient is still living, and in a fair degree of physical health, subject to convulsions about once in ten days. He has had some return of the pain, variously distributed, and comparatively light in character. There is but a very slight paresis of the right hand and arm. However, his condition even now is much better and more endurable than before the surgical interference, which undoubtedly secured him great relief from pain, and a couple of months of comparative health, with complete freedom from convulsions. The nature of the lesion alone seems to have prevented a complete cure.

CASE III. *Idiocy with generalized and continuous choreoid movements of seven years' duration. Trephining over motor zones; complete cessation of movements without paralysis; death on third day.*—Barney F., eight years of age, was born in Germany of healthy parentage. There is no history of family neurotic taint, and four younger children, brothers and sisters, are in perfect health. The mother insists that she carried him a year *in utero*, but the birth was not unusually difficult and without instrumentation. He appeared in all respects as other infants until the age of three months, when he was one day found with pale face, blue lips, eyes rolled up under lids, and unconscious. He was restored with difficulty in half an hour. The parents thought the infant had been accidentally smothered with pillows thrown on him by other children, but of this there is no surety. At the age of one year he made a crying or calling noise in the night, and was again found in a similar state, lasting a considerable time. From that date he showed choreic movements without interruption. He has never talked, and the use of hands, arms, and legs is very imperfect, as is his control of bladder and rectum. The gait is peculiar, the weight being carried on the toes unsteadily owing to the choreic contortions, and when standing he usually is bent forward with his hands between his knees, like one suffering with cold, his face meanwhile grimacing and his mouth in motion like an animal taking the teat. He gnaws his fingers, pulls at his ears, and when undressed constantly toys with his penis. At times he will rub the back of his head for a quarter of an hour continuously. He can only articulate the one word "ma," and attempts no response or recognition on being spoken to, though hearing and sight are fairly acute. He manifests likes and dislikes in regard to his food, and has some faint idea of right and wrong, or at least knows when to expect punishment. His mother and brothers and sisters he recognizes at once from other people, and manifests some affection for them, but his intelligence is very feeble. The face, trunk, extremities, and eyes are in constant choreic action during the waking hours, but when asleep there is complete freedom from such movement. At times he is noisy, making peculiar animal-like grunts and bellowing sounds. Physically the health is fair. The head is much contracted anteriorly, as is not unusual in such mental states. (Fig. 7.)

FIG. 7.



Showing characteristic attitude and grimace in Case III.

In substantially this condition he was admitted to St. Elizabeth's Hospital July 15, 1889, in the service of Dr. Frank, his parents clamoring for an operation on the brain, having learned of the case of May M., who at that time was presenting great improvement. The gravity of the matter was fully explained to them, and its experimental nature as well as the lack of indications of localizable lesions. It was clearly pointed out that the operation would be exploratory, and probably would result in finding nothing. Finally, upon the continued solicitation of the family, and with the advice of Dr. Luken, attending physician, it was decided to explore the brain. The head was accordingly prepared for the operation in the manner already indicated.

July 19, 1889. Chloroform was used. Dr. Frank operated, assisted by Dr. Luken and the hospital staff.

First, on the left side three buttons of bone were removed, one with a trephine one and a quarter inch in diameter, the others with a three-quarter inch instrument, making an opening about one and a half by two inches. Nothing unusual was found but the dura, which was fully twice an ordinary thickness. A similar opening was also made on the right side, but a little smaller, and through these the inside of the skull, of the dura, and the surface of the brain were thoroughly investigated. The dura was equally thick on the right side. A little of the brain tissue, thirty-two grains in all, was removed from the motor cortex on both sides, and mainly from the ascending gyres. The wounds were then closed, drained, and dressed as already described in the preceding cases.

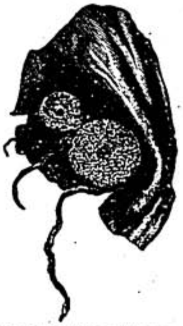
The patient recovered promptly from the operation, and twenty minutes after being put to bed made voluntary movements with all his extremities except the right arm. Toward evening he was restless, and received hypodermically one-sixteenth of a grain of morphine, which was repeated at midnight. *Free from choreic movements.*

20th. 7 A. M. Had a fair night. Has good use of all his limbs. The reflexes are intact. Swallows liquids put in his mouth. Temperature 101° F.

8 P. M. The dressing is soaked through, and when changed gave rise to considerable vigorous struggling. Patient would look up when called by name. Temperature 99$\frac{1}{2}$°.

Midnight. Temperature 100$\frac{3}{5}$°. Pulse strong, full, and easily counted.

FIG. 8.



Portion of thickened dura with adherent bone buttons removed post-mortem. A few strands of iodoform wicking are attached. One-half actual size.

21st. Passed a quiet day. He can use his legs better than his arms, which he moves but seldom. Temperature, at 7 A. M. 99$\frac{3}{5}$°, at 7 P. M. 101$\frac{9}{10}$°. At this later hour he is stuporous and hard to rouse. He swallows readily, and grunts in his peculiar way a good deal. 9.30 P. M. Dressing changed, as it was saturated with fluid from within the skull, the scalp wound being quite dry, and mainly from the right side. *No choreic movements.*

22*d.* 7 A.M.—Rested quietly. About 2 A.M. showed some difficulty in swallowing. Temperature 100⅖°; pulse 150, and very small. Cannot swallow. Lies perfectly still. Reflexes abolished. Died at 8.40 A.M.

The *post-mortem* examination, made very hastily, as it was objected to by the parents and went no further than the skull, showed the parts to be all healing by first intention, and very nicely. The buttons of bone in this short time were already firmly adherent to the dura, and two of them so attached are shown in Fig. 8, from a recently made photograph of the alcoholic specimen. There was a disintegrating small clot at the site of the subdural drainage-tube, and a small area of brain substance broken down at the same point. About the brain there was nothing abnormal; the dura was uniformly and everywhere greatly thickened.

CASE IV. *Fracture of the skull. Subdural hemorrhage localized. Trephining and removal of clots with relief of symptoms; death due to intra-abdominal hemorrhage from ruptured liver.*—Mary K., æt. twenty-three, an unmarried Bohemian servant-girl, was admitted to St. Elizabeth's Hospital November 21, 1889, in a comatose condition, and assigned to the service of Dr. Frank. During the summer she had suffered continuously with articular rheumatism. In the previous five weeks there had been a severe exacerbation, from which she was just convalescing. A few days before the accident which led to her admission she had manifested a complete change of disposition, becoming quarrelsome, depressed, and fault-finding, instead of cheerful and contented, as was her natural wont. She was emotional and despondent. About noon on the above date, shortly after going to the closet, she jumped from a third-story window, evidently with suicidal intent, and struck upon a wooden pavement, but just how she came in contact with the ground could not be ascertained. She was picked up insensible, and brought directly to the hospital. Deep coma and stertorous breathing were present. Blood oozed from the left ear and nostril, and there was a slight contusion of the scalp over the right parietal eminence. The left pupil was widely dilated and immovable. There was no recognition of, or reaction to, painful sensations. The left arm was completely paralyzed and relaxed, the left lower extremity less so. The right side showed a little resistance to passive movements. Five ribs, from the fifth to the ninth inclusive, on the right side were fractured.

Guided by the bleeding from the left ear and nostril the skull was trephined with a large instrument of an inch and a quarter diameter, through the squamous portion of the left temporal bone, which showed a stellate fracture. The dura bulged without pulsating very firmly into the opening and felt very tense. When a slight opening was made in it there was an alarming spurt of bloody fluid which streamed out as under great pressure to a distance of three or four feet, probably as much as six ounces so escaping. The meningeal artery was tied and the dura raised as in the preceding cases. A few insignificant clots were found and a little oozing of blood from the brain surface. The skull was explored in all directions with the finger within the dura, and as far as possible between the dura and the bone, but no inequalities were palpable. The operation was commenced without an anæsthetic, but in placing the interlocking stitches some pain was occasioned and the patient freely moved the right extremities, but never made any movements on the left side. Chloroform was used to produce anæsthesia.

The left hemiparesis persisting after the above-mentioned procedure, it was determined to open the right side of the skull over the motor area. A director passed through a small incision in the contused scalp and carefully swept around on the surface of the skull finally detected a fracture, without depression or displacement, near the parietal eminence. In the usual manner the skull was trephined at this point and the tense bulging dura exposed. There was considerable bleeding from the bone which was readily and instantly controlled by means of the pins of decalcified bone, shown in Fig. 9, devised for this purpose by Dr. Frank and manufactured by Schorse & Co., of Milwaukee. They have proven of great value in other operations upon osseous structures. On this side even a greater quantity of fluid similarly escaped. The amount so evacuated was not measured, but must have been altogether at least twelve ounces.

FIG. 9.

Pin of decalcified bone to control hemorrhage in bone operations. Two-thirds actual size.

After free drainage had been secured on the left side it was difficult to understand the persistence of pressure on the right and the retention of this fluid. The query was raised whether the falx under such circumstances could act in a valvular manner. When the dura was opened large clots were found covering the surface of the brain on its lateral convexity and extending into the posterior cranial fossa on the right side. They were scooped out and much bleeding ensued from the pial circulation, which seemed also to be the source of the clots. By exploring in all directions with the finger the arachnoid was broken down, and this, as in the first case, was followed by cessation of hemorrhage.

The wounds were closed, drained, and dressed as already described. The breathing at once became natural and the patient moved all her extremities freely during the completion of the dressing, and subsequently upon painful stimulation. Complete consciousness was never regained and she gradually sank and died twenty-four hours after the operation.

By *post-mortem* examination the skull was found widely fractured from the right parietal across the vertex to the opposite temporal bone, then through the petrous portion, the roof of the orbit, and the cribriform plate of the ethmoid. A small fragment from the lesser left wing of the sphenoid was completely separated. The operation wounds were dry and aseptic and the cerebrum looked clean and smooth as if it had never been covered with clots and effused fluid. The abdominal cavity was filled with blood from a rupture on the surface of the liver corresponding to the fractured ribs, and to this death can reasonably be attributed.

In these operations a number of practical points were developed. The control of scalp hæmorrhage with the interlocking stitches was very satisfactory, and when black and white silk were alternated the manœuvre could be quickly and readily executed. The special forceps figured in Fig. 1 also gave great assistance. The use of irrigation on the brain tissue, though not heretofore advised, proved a great help in clearing the field of obscuring blood, and properly employed with a low pressure seems perfectly allowable. It certainly is less severe upon the cerebral structure than sponging. As to drainage, tubing undoubtedly has the disadvantage of being bulky, but the large amount of fluid regularly discharged in such cases requires an adequate means of escape, otherwise pressure will be brought to bear on the dural flap and probably defeat its union by first intention, upon which so much depends. The dressings must be such as to care for this discharge and for the same reason require frequent changing.

When the bone is to be replaced it should be taken out in as few pieces as possible, preferably in a single piece. The return of small fragments and chips as shown in these cases is of doubtful utility. Efforts may profitably be directed to securing the returned bone to the cranium in the most desirable and favorable position for immediate union and the prevention of deformity. Upon this, ultimate success and the bony protection of the encephalon may hinge.

The brain's tolerance of prolonged and vigorous manipulation is forcibly demonstrated, and its recuperative power after injury and regional loss is again made manifest.

CLINICAL RESULTS OF GASTRIC FARADIZATION.[1]

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For some years various gastric disorders have been treated by electricity, both the continuous and interrupted currents being employed. Somewhat over two years ago it occurred to me to employ the current from within the stomach, and to this end I contrived an electrode, a description of which was published in *The Medical Record* of November 9, 1889. Clinical reports of my experience with this method of treatment have been promised for some time, but, for various reasons, the fulfilment of the promise has been delayed until the present. For convenience' sake it seems best to speak first of those disorders of digestion which depend upon structural diseases of the stomach, and second of those disorders that are functional in character.

Of the disorders depending upon structural diseases, electricity has

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[1] Read before the Fifteenth Annual Meeting of the Alumni Association of the University of Buffalo, Medical Department, 1890.